DOCUMENT RESUME

ED 136 255 CS 203 199

AUTHOR Olson, David R.; Nickerson, Nancy
TITLE Language Development through the School Years: Learning to Confine Interpretation to the Information in the Text.
PUB DATE Mar 77
NOTE 28p.; Paper presented at the Conference on Text, Context and Message for The Ontario Institute for Studies in Education (March 1977)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Cognitive Development; *Cognitive Processes; Elementary Education; *Language Development; Language Research; Linguistic Theory; *Literacy; Primary Education; School Role; *Speech Communication; *Written Language

ABSTRACT

The properties of written, textual language with which children deal in school can be distinguished from those of oral language by examining the manner in which interpersonal and logical functions are stressed and by assessing the degree to which interpretation is confined by meaning explicitly stated in textual matter. The developmental process whereby children acquire the skills necessary to understand written language occurs primarily during the school years and can tentatively be attributed to schooling itself. A review of theory and research in the area of language development suggests, then that the ability to confine interpretation to information explicitly stated in texts and to derive logical conclusions from written materials is related largely to the development of literacy. (KS)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Language development through the school years: Learning to confine interpretation to the information in the text

David R. Olson

The Ontario Institute for Studies in Education

Toronto, Ontario

PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY

David R. Olson

TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER.

ED136255

Our concern in this paper is with some aspects of language development which occur primarily during the school years and which at least tentatively, can be attributed to schooling. We shall begin by attempting to provide two primary distinguishing properties of written, textual language which children work with in the school. These two features, which we have taken as most significant for an understanding of "schooled" language as opposed to an oral "mother tongue", are firstly, the realignment of the interpersonal and the logical functions of language, and secondly, the attempt to confine interpretation to the meaning explicitly conventionalized "in the text". We shall develop each of these themes in turn.

The functions of language

An analysis of language in terms of functions, as opposed to the simple acquisition of semantic systems or syntactic devices, appears to offer a promising approach to the nature and development of language. Any one of a number of theories (Buhler, 1934; Austin, 1962; Searle, 1969) could set the stage for the discussion of the functions

---

I am grateful to Nancy Nickerson for her assistance in the preparation of this paper.

Prepared for the conference on Text, Context and Message. Toronto: OISE, March 1977.

CS 203 199

of language. The two classes of functions of primary concern to us are (1) the functions of regulating social relations between participants and (2) the functions of maintaining logical relations within and between sentences. Extending the work of Buhler (1934), Popper (1972) argues that there is an evolution from animal languages to human languages, from the "lower" interpersonal signalling functions shared by animals and humans which are useful for coordinating and controlling the behaviour of others, to the "higher" semantic functions which are found only in human language and are useful for constructing true and valid descriptions. This dichotomy also reflects Austin's (1962) distinction between performative utterances and constative utterances or between illocutionary and locutionary acts. An implication of Austin's argument is that an analysis requires that we recognize, and if necessary, distinguish what the sentence means "literally" and semantically, from what the speaker means, intends, hopes to achieve, or achieves by uttering that sentence. This is a point which has been elaborated by Grice (1975).

Our suggestion is that in ordinary conversational language what is said provides only some cues to what the speaker intends. The shared prior knowledge, the shared perceptual context, preceeding utterances in the conversation, the assumed biases of the listener plus a host of prosodic[1] and paralinguistic cues all share in the expression and

---

[1] Interestingly, according to the OED, the prosodic features of language, those aspects of language relevant to versification; intonation, stress, rhyme and meter, were "formerly reckoned as part of grammar."

recovery of the speaker's intention. What is said is only a fragmentary representation of what was meant. In schooled language, as we shall see, the relation between what is said and what is meant is much more direct. Meanwhile, it is important to notice that what a sentence means and what one means by a sentence may be quite different.

An interesting analysis of the structure of language in terms of its functions has been advanced by Halliday (1970). More recently he has used this analysis of functions to account for the acquisition of language in children (1974, 1975). At an early age, prior to one year, Halliday found evidence of five functions served by the child's distinctive expressions which he describes as the instrumental, regulatory, interactional, personal and imaginative functions. By about two years of age, the child has integrated these functions into the three primary functions of adult language, the interpersonal function, the ideational function and the textual function. With development, the child's utterances become plurifunctional such that for instance, the logical subject of a sentence is determined by the ideational function, the grammatical subject by the interpersonal function, and the psychological subject by the textual function. Other studies of child language acquisition have tended to support these distinctions. Nelson (1973) found that some children appeared to be primarily oriented towards the interpersonal functions of language while others were oriented towards the ideational functions of language--"One is learning an object language, one a social interaction language" (p. 22). Others have suggested that the interpersonal function is primary over the ideational function. Buhler (1934) claimed that "the first

sensible words are either such affective expressions, or the signs of some wish" (p. 55). Bates, Camaioni and Volterra (1975) suggest that children pass through an illocutionary or interpersonal stage before they reach a locutionary stage.

The alignment of functions in ordinary oral language

This view of ordinary language simultaneously serving several functions has much in common with that recently advanced by Gellner (1973) to characterize non-literate uses of language. The ordinary language described by Halliday has the same integration or non-differentiation of functions as the Savage language described by Gellner:

> It is the essence of the savage mind, as of savage institutions, that there is a lower degree of functional specificity....The enchanted (Savage) vision works through the systematic conflation of descriptive, evaluative, identificating, status-confering etc. roles of language (p. 174).

The Modern mind, on the other hand, differentiates the functions of language and specializes the language to more effectively serve those functions. Horton (1970) puts it this way:

> One theory is judged better than another with explicit reference to its efficacy in explanation and prediction. And as these ends become more clearly defined, it gets increasingly evident that no other ends are compatible with them. People come to see that if ideas are to be used as efficient tools of explanation and prediction, they must not be allowed to become tools of anything else (p. 161).

With Gellner and Horton, we suggest that the Modern mind is characterized by the differentiation and specialization of two primary language functions, the logical and the interpersonal. Unlike them, we

suggest that this differentiation, specialization and realignment of functions is a consequence of literacy. Although adult language simultaneously serves a number of functions including that of regulating social interaction and making true descriptions, ordinary oral language is primarily interpersonally biased in that it is directed to a particular individual, usually with some intended effect whether influencing his views, maintaining a certain social relationship or controlling his actions. Furthermore, the availability of immediate feedback permits the continuous monitoring of the listener to determine if the utterance needs to be modified, expanded, tempered or the like to achieve that effect. Hence the rhetorical function is predominant over the logical function: if you fail to maintain an appropriate interpersonal relationship, the conversation simply terminates. The predominance of the interpersonal function over the truth or logical function may be illustrated by noting that in ordinary conversation, topics are chosen for which the participants already share most of the relevant knowledge. These topics frequently include a common ancestry, a common geographic origin, a common contextual event ("Chilly, isn't it?") or failing that, a recently seen movie, read book or the like, less for exchanging information than for establishing a social position or for developing an interpersonal relationship.

The primacy of the interpersonal functions over the logical functions in oral language is clearly shown in a recent study by Esther Goody (1975) of the use of questions among the Gonja of Ghana. After differentiating the locutionary (information) functions from the illocutionary (interpersonal or control) functions, she shows that the majority

of questions among the Gonja weavers were used not for the purpose of obtaining or sharing information, but for purposes of control over lower social status individuals, generally children. Thus, a teacher can question a child but a child cannot "ask" a question of a teacher. She concludes that: "The securing of information becomes secondary to considerations of status relations" (1975, p. 42).

Goody suggests that this subordination of the semantic and logical functions to the interpersonal, control functions in the use of questions may contrast substantially with the use of questions in our own society. How great that contrast is remains to be seen. Our expectancy is that the interpersonal functions are primary to the logical functions in the ordinary oral language of all cultures whether non-literate, like the Gonja, or literate, like ourselves.

The formal language of instruction appears to be quite different from the informal conversational language; it is perhaps half-way between spoken "utterances" and written "texts". The relationship between the interpersonal and the logical functions of language begin to reverse. Feldman and Wertsch (preprint), in an investigation of the language of teachers, report differences in classroom speech and conversational speech, in that some of the markers of the interpersonal function, what they call stance indicators, are absent in classroom speech. Thus, in the lunchroom, teachers use such expressions as "it seems to me...", "I certainly expect (hope)...", and the like to qualify their statements, while in the classroom these qualifiers are absent. To some extent teachers talk as if they are representations of the authorized view presented in text books!

However, even if the content expressed in teachers' language suspends the rhetorical stance of ordinary communication, the exhaustive analysis of "teacher talk" reported by Bellack, Kliebard, Hyman and Smith (1966) indicates that teachers continue to utilize the control functions of ordinary language in their use of questions in the clasroom. Although their data were not analysed precisely according to the functions discussed above, they showed that in a High School teaching session, almost 50% of teacher's utterances were "soliciting" moves--questions and commands--to which a student response was required. As a result 65% of students' utterances were responses to teachers' soliciting moves. Questions and commands were, therefore, used less to provide information (the logical or ideational function) than they were to hold children responsible (the control function) for the information they had, presumably, acquired from the text. Further Bellack et al reported the same absence of stance indicators reported by Feldman and Wertsch. Thus, in spite of the fact that teachers were teaching highly controversial material, only 2% of teachers' utterances in the classroom conveyed or justified personal opinions. Interestingly, this suggests that by the time the child reaches High School classroom language has become highly specialized. Oral language may be seen as more-or-less inappropriate for carrying out the ideational functions of language which are, therefore, assigned to the reading of text. The teacher, retaining the more interpersonal, control functions of oral language becomes primarily a "mediator" of texts. This gradual transition to written text during the school years is an important but relatively uncharted territory.

The realignment of functions in "schooled" language

The essence of "schooled" language is that it reflects the formal language of written texts. It involves what Greenfield (1972) called "speaking a written language". Written language has the effect of distancing the speaker from the listener with the effect that the rhetorical or interpersonal functions become somewhat secondary to the ideational or logical functions of language. Text books, the most characteristic representatives of this form of language, are particularly striking for their anonymity. It is not clear who is speaking or to whom the information is being addressed. It is an attempt at a simple, impersonal, autonomous, true description. A text book is not merely the author's opinion of a state of affairs but rather the expression of what is known. The primary difference, we suggest between the oral conversational language of the child and the written texts of the school, is in the realignment of the interpersonal function and the ideational functions of language.

Some indications of this shift are visible in the studies mentioned above. Teachers in classrooms, as representatives of the official text view, rarely express their own feelings, beliefs, interpretations or opinions while in the staff rooms they are quite willing to relinquish that official stance. Yet even in the classroom, they do not relinquish that other aspect of the interpersonal function, the use of language to control the activities of children through the use of questions and commands. Presumably, a more detailed study of the language of the school would show a predominance of interpersonally biased oral language in the early grades with an increasing reliance on written text

and text-like language in the later grades. Through the school years, the child is becoming more reliant upon text books for the acquisition of information. That is, the realignment of functions of language corresponds to a transition from oral to written forms of language.

There are good reasons why the ideational functions of language are progressively turned over to written language. As we mentioned above, writing distances the speaker from the hearer in a way that decreases the urgency of the interpersonal component. Beyond that, the presence of a permanent artifact, the written record, permits the repeated scrutiny of what was actually said in a way that makes it much easier to check the truth and validity of the statements than would be the case in ordinary oral language. Written language by virtue of the fact that it is explicit, is substantially different from typical oral speech; it is relatively free of the effects of context and stands as a permanent artifact with meanings that endure through time. Part of this explicitness is required because of the loss of certain types of information that would normally be carried by expression, intonation, gestures and ostensive factors which must therefore be made explicit in the text. An illustration of the relative explicitness of written language is taken from Lyons (1969, p. 40) who pointed out that a large number of homophenes in spoken language are disambiguated by spelling. There are, for example, many such sentences which are ambiguous when spoken, that are perfectly clear when written ("cf., il vient toujours a sept heurs; il vient toujours a cette heure; he always comes at seven o'clock; he always comes at this time," p. 41). Moreover, text must be written in such a way that the "meaning" is unchanged if read in a different con-

text than that in which it was written. That is, written materials are ordinarily portable and preserved over time, hence the writer must use language in such a way as to permit the text to preserve its meaning across space and time.

Several scholars (Havelock, 1973; Gelb, 1952; McLuhan, 1962; Goody & Watt, 1968; Frye, 1971) on the basis of several distinctive lines of enquiry, have provided convincing evidence that this explicitness and permanence, particularly of (phonetic) alphabetic writing systems, permitted the growth of theoretical knowledge in science and philosophy.

Eric Havelock (1973) in his Prologue to Greek Literacy showed that the sudden blossoming of classical Greek thought could be attributed to the invention of the alphabet. The phonemic alphabet was invented much later than had been previously thought, so the Greeks of Plato's time were among the first to have access to it. Secondly, the much older Homeric epics were shown to be of strict oral composition--composed by authors who could not write for audiences who could not read (Parry, 1971). These poems constituted an oral or "tribal" encyclopedia, including procedures for regulating all the major social events of the culture--the problems of orderly succession of authority, settling disputes, and the like. Two consequences of a reliance upon orally coded information are particularly significant: first it put a severe demand on memory--memory, we may say, would be the dominant cognitive function; second, to make information memorable, the statements had to be biased in the direction of "poetized" speech--speech dependent on rhyme and rhythm, "sayings" of all sort, aphorisms, and proverbial lore. The language coded, as Havelock says, "a

panorama of happenings not a program of principles."

All of this changed with the invention of the alphabet. First, the presence of an available record made it unnecessary to carry all that information in memory, enabling cognitive processes to be deployed differently. It is analogous to doing long division in the head compared to doing it on paper. Second, writing produced an enduring artifact that could be repeatedly scanned at the reader's leisure to see what was in fact said. Writing permits the criticism of statements in terms of what they said as opposed to what they meant or were intended to mean. In oral language, as I have said, it is almost impossible to differentiate what is said from what is meant. Third, and most important, because the alphabet was highly explicit, it did not rely to the same extent on the prior expectancies of the reader. An unvocalized syllabary text, for example, could not differentiate bell, ball, bull, and the appropriate rendering would have to come from the reader's expectancies. With an alphabet, one could write things that ran counter to expectancies. Text, therefore, became an instrument for the exploration of new ideas. While syllabic text could serve to retrieve what was previously known, alphabetic text could explore the unknown and still be read by another person.

The point I wish to draw from this argument is that an oral tradition provides a model for ordinary spoken language, for the "mother tongue", language that is context-dependent and relies for its meaning heavily upon the expectancies of the listeners. The written language of prose text breaks this tie to context and expectancies in a significant way. It is this attention to the statements per se and their logical entailments which written language permitted that according to Havelock,

made possible the rise of Greek philosophy and Greek science. And I wish to suggest, it is the progressive mastery of literacy, of schooled language that is responsible for a similar re-orientation to language by children. It is a progressive development from utterance to text.

Consider now some of the ways that the realignment of functions and the specialization of language introduced by written text influences the language process of the children who deal with text. Our interest is in the changes in the comprehension processes of children through the school years as they progressively learn to deal with autonomous, anonymous, printed texts. We shall describe one aspect of this development in terms of the children's ability to confine interpretation to the information explicitly represented in the text. This is a complex skill with a long educational history and our intention is simply to chart some of the milestones in its development.

The argument we present is, in some ways, merely an extension and elaboration of one presented earlier (Olson, 1972) in which two higher order semantic functions were differentiated. In that paper a contrast was drawn between the processes of mapping sentences onto a perceived world and the processes of mapping sentences onto other sentences. In the early stages of language development it was suggested that children learn how sentences relate to situations. Once those extensional properties had been mastered children came to see how sentences related to each other. This learning was said to occur by virtue of the fact that two descriptions mapped onto a common state of affairs and it was this

common extension that gave them their common meaning. One illustration was drawn from the relation between active and passive sentences. It was suggested that children first learned how to map sentences whether active or passive to a state of affairs. Only subsequently did they come to see that if one was true, then necessarily, the other was true as well. The same point was made of lexical meanings. A child may know the events that take particular lexical items as correct descriptions but fail to see that if one was true the other was necessarily true. For example, the child may describe a particular object as a "cat" and on another occasion as an "animal" and yet fail to see the defining relation between those two lexical items. Again, it was suggested that it was the common compliance class (Goodman, 1968, p. 144) of the two descriptions that was instrumental in the child's coming to see that the terms could be transformed or translated into one another. Finally, the argument was raised that these developments were, at least in part, the consequences of the reliance upon written language in the course of schooling. The former, the mapping of sentences onto situations, was described as the language of communication and instruction, while the latter, the mapping of sentences and lexemes onto each other was described as the language of explicit argument and of logical thinking. It is this latter process that we now describe as the specialization of the ideational function of language that occurs during the school years.

We shall describe this development in terms of the child's growing ability to handle the meanings of texts. This ability develops as the child passes through at least two stages from learning to match descriptions to known states of affairs (assimilation), to learning to imagine states of

affairs of which the presented sentence is a true description (accomodation). This latter involves learning to confine interpretation to the statements per se and to the conventionalized relations between those statements. Let us consider them in turn.

Mapping sentences to known events: Sentences as descriptions

One way we have examined the development of the literate use of language is by specifically examining children's competence with the relationships between active and passive sentences and sentences involving the comparative more/less and bigger/smaller. Logically, these three relations may be described as possessing two variable elements linked by a relation term such that A(R) B→B(R^-)A. A transformation applied to the variable elements or to the relation term produces a sentence that is false while the application of both yields a true sentence. Symmetrically, in comparing sentences, a mismatch in the order of the elements or a mismatch in the relation term makes one of the sentences false while a mismatch in both makes them equivalent.

A (R) B	John hit Mary	T
A (R^-) B	John was hit by Mary	F
B (R) A	Mary hit John	F
B (R^-) A	Mary was hit by John	T

The question of concern here is what does the child know about these relationships and how does that knowledge change with schooling.

We have known for some time that if you tell a child of, say, 5 years of age "John has more than Mary" he is unable to answer the question "Does Mary have less than John?". Similarly, if you tell him "John hit Mary" he is unable to answer the question "Was Mary hit by John?". We interpret this finding as a demonstration that young children fail to see the implications of statements. We were disturbed by the finding, however, that if you showed children a picture of the event portrayed by the first sentence they were able to answer the question. It seemed odd to claim that children could not draw implications from sentences if on some occasions they did appear to draw such implications.

In children's speech productions, too, Feider (1970) found that children 3 to 5 years of age were unable to apply both of these transformations to a sentence to form the complementary sentence. Two examples are given below with the adult form in brackets beneath:

1. Was I a baby, when I was standing on my head?
   (Was I standing on my head when I was a baby?)
2. I am strong. I can beat Jackie up. That's why I'm strong.
   (I am strong. I can beat Jackie up. That's why I can beat Jackie up. That's because I'm strong.) The child in the above cases has carried out one of the transformations but not the other, hence the statements appear odd. To illustrate in 2., the child says "That's why I'm strong" when he meant "That's why I can beat Jackie up" or alternatively, "That's because I'm strong". The child's response fell neatly between these alternatives.

We recently conducted some experiments that cast a new light on this particular competence. In one of these experiments (Olson &

Nickerson, in press) we simply varied the degree to which the characters of the sentence were known to the children. In the pilot studies we used names of siblings and classmates. In the experiment we used the familiar Peanuts comic-strip characters, Snoopy, Lucy and Charlie Brown. There were four conditions. In the first we used the arbitrary names John and Mary that we had used in earlier studies, in the second, we used the familiar Peanuts names, in the third, we used the Peanuts names embedded in a meaningful story and in the fourth we used our pictures.

Two findings emerged. The more well-known the characters the better able were children to draw the correct implications. In terms of the theory I have been developing here, the more readily sentences could be assimilated to the child's commonsense knowledge of the world, the more successful was he in handling the grammatical-logical relations between sentences.

The second finding is more surprising. By performing an analysis on the number of correct responses to the sentence-question pairs we were able to show that children, when successful, proceed in a manner different from that of adults: for adults True Passives are most difficult; for children False Passives are most difficult. To account for these differences, we have postulated different processing models for children and adults. Adults, in these experiments, operate directly on the logical implications of the statements: If x hit y, then y was hit by x. Adults simply compare sequentially the constituents of the representations of the sentences keeping track of the mismatches by means of some truth index. Their reaction times reflect the number of these operations. For adults, we may say that the meaning operated on is in the text, or alternatively

that sentences are treated as propositions.

Children on the other hand, cannot calculate the logical implications of the statements per se. How, then, do they come to see the equivalence relation between transformed versions of the same proposition? Both children and adults, at least when the contextual knowledge was adequate were able to assimilate the various forms of sentences described in these kinds of experiments. The children also, at least in some contexts, were able to come up with the same answers as adults. But they came to their conclusions in quite a different way. Adults, knowing the logical relations between the sentences, were able to retrieve and compare the critical constituents and make a judgement. Children, not knowing the logical or formal relations between the sentence meanings, had to assimilate what they heard to what they already knew using some context or background knowledge and then redescribe what they knew to fit the requirements of the questions. They achieved by assimilation and redescription what adults did by the comparison of constituents related by formal transformations. While children operate upon their more general knowledge representations, adults operate upon the more specific sentence representations.

Confining interpretation to the text

All of the children we studied had mastered the grammar and the semantics of the language; they could assimilate both active and passive sentences to their knowledge of the world (if there was a context to which it could be assimilated). In other words, they knew how to map language onto knowledge. However, that grammatical competence, was no assurance that the child knew the implicational relations that hold between

the sentences per se or that he can transform one statement into another. A young child's judgement that two sentences are both true would be made on the basis of paraphrase--they are both true descriptions of some known event--not on the basis of formal logical entailment or grammatical transformation of the sentence meaning directly. Another way to say this is that children treat these sentences as empirically related, that is, they are both true descriptions of a state of affairs, while adults treat them as formally or logically related--if one is true, necessarily the other is true.

And this we suggest is what children are acquiring in their early school years. They are learning to treat sentence meaning formally; to entertain sentences not merely as a transparent description of an underlying reality, but rather as the reality. They operate on this reality to create a meaning. This we have called sentence accommodation. Rather than merely assimilate a sentence (sometimes with some violence to the sentence per se) as a fragmentary clue to the intended or speaker's meaning, the child begins to accommodate himself to the sentence--to imagine a state of affairs of which that sentence is a true description. To do this, of course, the child must have both a highly conventionalized linguistic system and a willingness to entertain the reality specified by the statements that he encounters. It is the growing competence with these formalized meaning constituents that we have seen emerging in these studies.

This is not an achievement that is independent of other aspects of the child's development; there are, presumably several stages involved in the mastery of the logically related statements we have examined herein.

There is first of all, as mentioned above, the development of sentence accommodation--the ability to create or imagine a state of affairs of which that sentence is a true description. This is a process that presumably begins with story telling and story reading and ends with expository text.

Secondly, even if the primary difficulty children have with these sentences is constructing a meaning on the basis of the sentence, there is a further difficulty, the knowledge of the effects of pairs of transformations that produce logically equivalent statements (e.g., John hit Mary = Mary was hit by John). The child lacks the knowledge that when both transformations are applied, either of which alone have the effect of making the sentence false, the application of both makes the sentence true. This knowledge would seem to be presupposed in the use of the adult models that we have outlined. Even when children did use this adult model (without recoding) as they did in a recent experiment the effect was that when a double mismatch occurred they performed at chance. They gave no evidence of realizing that the consequence of the application of both transformations together was a true, equivalent sentence. The absence of the realization could be taken as a sign that the child's thought is not operational and that his difficulty with such statements could be explained by recourse to some underlying logical development. This possibility is not essentially different from the one suggested herein. Children appear to deal with implications, relations and the like as long as the alternative descriptions apply to the knowledge of some state of affairs. They utilize both transformations, independently, in the course of assimilating sentences to some well known state of affairs. As a consequence, they treat logically related statements as if they are

simply paraphrases of one another, that is as correct descriptions of that state of affairs. They fail to realize that once the transformations are conventionalized in the language, one statement can be generated from another by means of the linguistic conventions themselves rather than by recourse to knowledge of the world. The mastery of those conventions, we suggest, is what makes the purely logical relations possible. But that does not, in our view, require some non-linguistic, logical or operational development to underly these transformations, but involves the conventionalization or formalization of the linguistic relations themselves.

Thirdly, the evidence suggests the possibility that the difficulty for children with these inter-sentence relations reflects a general limitation in the information handling capacities of the children as well as acquisition of either the linguistic conventions or logical operations. It may be noted that adults carry out two mismatch operations and yet arrive at a true judgement while children perform quite well if they encounter one mismatch but fail when they encounter two of them. The successful strategy that children employ, the redescription strategy, had the effect of reducing the mismatch to one and in that case they tended to get the equivalence item correct. Generally, too, it was our observation that children got confused when there was more than one mismatch, as indeed adults do on the early trials of these tasks. While the amount of information to be processed undoubtedly effects the difficulty of the tasks, it is not clear that that is the principle difference between children and adults. It is not merely that the equivalence sentences involve two mismatches that makes them difficult but the fact that the two transformations have the

effect of nullifying each other, and that is a relationship within language that holds only because it has previously held in the child's knowledge of the world. It is a matter of conventionalizing in language itself a relation that has held between sentences and situations. And presumably it is these conventions that the child progressively masters through the formal study of written texts during the school years.

We believe the effect of writing then is to turn utterances as descriptions into formal propositions with implications. Sentences may be treated in either way; and while our children treat them as descriptions of known events, our adults treat them as logical propositions. This jump is fundamental to cognitive development in a literate culture but it is achieved, I suggest, primarily through the reflection on statements made possible by writing systems. And the children here are doing what we literate adults frequently do in ordinary conversational language.

But if this is true, namely that children do not calculate the logical implications of texts directly, but rather assimilate sentences to what they know and expect, we can make some further predictions. When the logic of the statements runs counter to the structure of known events, children will tend to follow the structure of these events, not the logical structure of the statements. Evidence for the powerful effect of expectancies formed by the child's perceptions has been obtained by Donaldson & Lloyd (1974) and Clark (1973). Now, if the analysis of implications of statements is tied to literacy rather than to a stage of development, we may expect to find that this achievement is related to passage through the school system in our culture and does not occur at all for

adults in traditional, non-literate cultures. This is precisely what Cole, Gay, Glick and Sharp (1971) report in their studies of the cognitive processes of the adult Kpelle of Liberia. Here is one of their problems:

Experimenter: Flumo and Yakpalo always drink cane juice (rum) together. Flumo is drinking cane juice. Is Yakpalo drinking cane juice?

Subject: That day Flumo was drinking the cane juice. Yakpalo was not there on that day.

Experimenter: What is the reason?

Subject: The reason is that Yakpalo went to his farm on that day and Flumo remained in town on that day (1971, p. 187-8).

Notice that the subject's answer was both conjectural and plausible. It suffered only in that it did not logically follow from the explicit premise. The subject failed to treat a sentence as a logical premise.

In our Laboratory, Angela Hildyard (1976) recently required children who had had 1, 3, or 5 years of schooling (roughly 6, 11, and 12 year olds) to draw logical inferences from presented premises involving spatial and temporal relations. Statements were of the form A > B, B > C. The questions involved inferences of the form A > C. The independent variable was the nature of the material in which these logical relations were embedded: Formal statements, Counter Factual statements and Meaningful texts and some other conditions I cannot detail here. As in the Nickerson study, Hildyard found that children had little or no difficulty drawing

logical inferences when they were compatible with what the child knew or believed but had great difficulty when the same relations were given formally but without a supporting knowledge base. To illustrate, if children hear that: "The elephant is ahead of the giraffe and the camel is behind the giraffe" and they are subsequently asked if the camel is ahead of the elephant, they perform poorly in early grades and performance improves significantly with grade level.

If, however, they are told that "The elephant is ahead of the giraffe because the giraffe's long neck kept getting tangled in the thick tree branches" and "The camel is behind the giraffe because the camel frequently stopped to eat", the young children do very well in drawing the correct inference and, moreover, on such items there is little improvement with age. Hildyard concludes that children can indeed draw logical implications from stated relations if those relations can be assimilated to the child's prior knowledge base. What grows with development, or with schooling, is the ability to draw logical inferences whose sole distinguishing quality is that they follow necessarily from the explicitly presented statements.

This developing ability to detach oneself from prior expectancies and to constrain one's interpretation of verbal material to what is explicitly stated, has also been demonstrated in a series of studies in our Laboratory by William Ford (1976). These studies have been concerned with the effects of semantic content on the interpretation of the disjunction "or".

The normal commonsense interpretation of the word "or", assumes an act of choice between two semantic elements which are mutually exclu-

sive. When the young child is asked, "Do you want an apple or a peach?" he is expected to select one item and the alternatives are mutually exclusive. In formal logical analyses, however, not only is this act of choice suspended, but the concepts are not necessarily mutually exclusive e.g., "Give me the yellow things or the bananas." It is these latter items that experimental studies of the logical development of children have shown to be difficult or impossible for children younger than 12-13 years.

In one study, Ford presented subjects from each of four age groups (5 years, 7 years, 8 years and adults) with selection tasks in which a set of disjunctive commands varied both in semantic content and hence in the degree to which they were mutually exclusive (e.g., dog/cat, dog/animal, dog/brown), and in linguistic form (unqualified "or", "or both", "but not both"). The pattern of instances selected as answers to each of the disjunctive commands served as the dependent variable.

Ford found that strong developmental differences occurred when the items formed inclusive or intersecting semantic relationships. However, where items preserved natural language presuppositions, young children were as accurate as adults in their responses. As predicted, only older subjects correctly responded to items in which the alternatives were not mutually exclusive. Ford concluded that with development children became increasingly skilled in dealing with statements in which ordinary language presuppositions are violated. In our terms, children learn to create a meaning for which the sentence is a true description even when those statements violate the conventional presuppositions of ordinary oral language.

In our view thus far we have attempted to show how children gradually become able to manipulate linguistic propositions and to rely exclusively upon the information explicitly presented in the sentence. When children come to school, they bring with them a set of procedures for assigning meanings to language primarily in terms of the interpersonal functions that the language is to serve, while assuming a shared common-sense picture of reality. With development, they come to see past those interpersonal functions and to operate upon the explicit logical properties of the sentences. In so doing they become able to derive implications which follow necessarily from the statements themselves rather than from that assumed implicit knowledge base.

Our tentative conclusion is that the form of human competence involved in constructing a practical model of reality, in making predictions intelligently on the basis of that model, and in assimilating oral statements to that picture of reality, is the general and largely universal possession of mankind, young and old, literate and illiterate. But the form of human competence involved in the ability to confine interpretation to the information explicitly stated in the text and to then operate on that meaning to derive logical entailments is tied largely to the development of literacy.

References

Austin, J.L. How to do things with words. Edited by J.O. Urmson. New York: Oxford University Press, 1962.

Bates, E., Camaioni, L. and Volterra, V. The acquisition of performatives prior to speech. Merrill-Palmer Quarterly, 1975, 21, 205-226.

Bellack, A.A., Kliebard, H ..., Hyman, R.T. and Smith, F.L. The language of the classroom. New York: Teacher's College Press, 1966.

Buhler, K. Sprachtheorie. Jana: Verlag, 1934.

Clark, E. Non-linguistic strategies and the acquisition of word meaning. Cognition, 1973, 2, 161-182.

Cole, M.; Gay, J.; Glick, J. and Sharp, D. The cultural context of learning and thinking. New York: Basic Books, 1971.

Donaldson, M. and Lloyd, P. Sentences and situations: Children's judgements of match and mismatch. In F. Bresson (Ed.), Current Problems in Psycholinguistics. Paris: Editions du Centre National de la Research Scientific, 1974, 73-86.

Feldman, C.F. and Wertsch, J.V. Context dependent properties of teachers' speech. (preprint)

Ford, W.G. The language of disjunction. Unpublished doctoral dissertation. Toronto: University of Toronto, 1976.

Frye, N. The critical path. Bloomington: Indiana University Press, 1971.

Gelb, K.J. A study of writing. Chicago: University of Chicago, 1952.

Gellner, E. The save and modern mind. In R. Horton and R. Finnegan (Eds.), Modes of Thought. London: Faber and Faber, 1973.

Goodman, N. Languages of art: An approach to a theory of symbols. Indianapolis: Bobbs-Merrill, 1968.

Goody, E. Towards a theory of questions. Draft of the Malinowski lecture, London School of Economics, August, 1975.

Goody, J. and Watt, I. The consequences of literacy. Comparative Studies in Society and History, 1963, 5, 304-345. Also published in J. Goody, Literacy and traditional societies.

Greenfield, P.M. Oral or written language: The consequences for cognitive development in Africa, the United States and England. Language and Speech, 1972, 15, 169-178.

Grice, H.P. Logic and conversation. In P. Cole and J. Morgan (Eds.), Syntax and Semantics: Speech Acts. New York: Academic Press, 1975.

Halliday, M.A.K. Language structure and language function. In J. Lyons (Ed.), New Horizons in Linguistics. England: Penguin Books, 1970.

Halliday, M.A.K. Explorations in the functions of language. London: Edward Arnold Ltd., 1974.

Halliday, M.A.K. Learning how to mean. In Lenneberg and Lenneberg (Eds.), Foundations of Language Development, Vol. 2: A Multi-disciplinary Approach. Unesco: Academic Press, 1975.

Havelock, E. Prologue to Greek literacy. Lectures in memory of Louise Taft Semple, second series, 1966-1971. Cincinatti: University of Oklahoma Press for the University of Cincinatti Press, 1973.

Hildyard, A. Children's abilities to produce inferences from written and oral material. Unpublished doctoral dissertation. Toronto: University of Toronto, 1976.

Horton, R. African traditional thought and western science. In B.R. Wilson (Ed.), Rationality. Oxford: Blackwell, 1970.

Lyons, J. Introduction to theoretical linguistics. Cambridge: Cambridge University Press, 1969.

McLuhan, M. The Gutenberg galaxy. Toronto: University of Toronto Press, 1962.

Nelson, K. Structure and strategy in learning to talk. Monographs of the Society for Research in Child Development, 1973, 38, Serial #149, Nos. 1-2.

Olson, D.R. Language use for communicating, instructing and thinking. In R. Freedle and J.B. Carroll (Eds.), Language Comprehension and the Acquisition of Knowledge. New York: Winston/Wiley, 1972.

Olson, D.R. and Nickerson, N. The contexts of comprehension: Children's inability to draw implications from active and passive sentences. Journal of Experimental Child Psychology. (in press)

Parry, M. The making of Homeric verse. In A. Parry (Ed.), The Collected Papers of Milman Parry. Oxford: Clarendon Press, 1971.

Popper, K. Objective knowledge: An evolutionary approach. Oxford: Clarendon Press, 1972.

Searle, J.R. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press, 1969.